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**THE SOUTHERN LAKE MICHIGAN COASTAL EROSION STUDY:
BIBLIOGRAPHY OF PUBLICATIONS BY THE
ILLINOIS STATE GEOLOGICAL SURVEY
January 1988 through March 1993**

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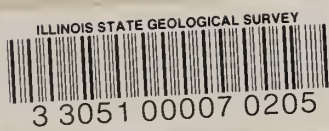
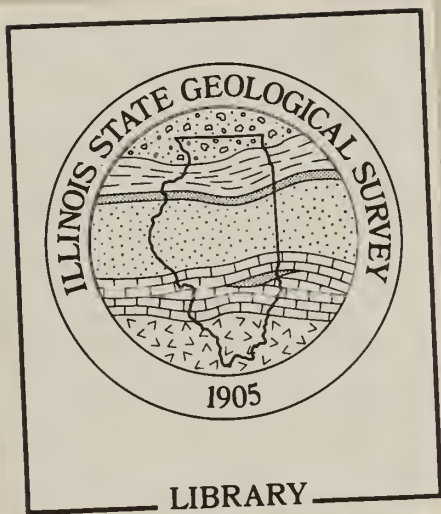
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INTRODUCTION

The Southern Lake Michigan Coastal Erosion Study was one of the first projects undertaken in what is now known as the National Coastal Geology Program of the U.S. Geological Survey (USGS). This program is designed to examine coastal geology of the U.S. ocean and Great Lakes coasts for the purpose of better understanding erosional processes, coastal pollution, and processes causing loss of coastal wetlands, as well as evaluating coastal hard-mineral resources. The southern Lake Michigan study was motivated by the record high levels of Lake Michigan that occurred in fall 1986 and winter 1987 that caused severe erosional problems along all of the Illinois and Indiana coast, and in particular, along the Chicago lakeshore. The high lake levels and the accompanying erosional problems established a need for coastal-geologic studies to provide data applicable to remedial action and mitigation along the Illinois and Indiana coasts.

The Southern Lake Michigan Coastal Erosion Study was a five-year study officially extending from October 1, 1987 through September 30, 1992 (*i.e.*, federal fiscal years 1987 through 1992). This was a cooperative study with the Atlantic and Pacific Marine Branches of the USGS, the state geological surveys in Illinois and Indiana, and university researchers in Illinois and Indiana involved in coastal studies. Additional contributions were made by researchers from universities in Washington and Oregon. During the course of the five-year project, participating researchers came from the following:

- U. S. Geological Survey (USGS)
- Illinois State Geological Survey (ISGS)
- Indiana Geological Survey (IGS)
- University of Illinois at Chicago, Department of Geology
- Northeastern Illinois University, Department of Geology
- Indiana University, Department of Geology
- Purdue University, School of Civil Engineering
- University of Washington, School of Oceanography
- Oregon State University, College of Oceanography

The project coordinator was Dr. David W. Folger, USGS Branch of Atlantic Marine Geology, Woods Hole, Massachusetts. The project was overseen by the USGS Center for Coastal Geology, St. Petersburg, Florida. Several researchers were funded by the USGS through the Illinois-Indiana Sea Grant College Program. Because of a contract funding cycle, the ISGS participation in the study extended from January 1988 through March 1993.



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The Southern Lake Michigan Coastal Erosion Study was divided into three categories of study:

1) Geologic Framework

Studies related to documenting geologic setting, coastal geomorphology, and coastal evolution.

2) Lake-Level History

Studies related to reconstructing lake-level history over the past 5,500 years to determine if lake levels in the recent geologic past exceeded the extreme high levels that have occurred during historical time.

3) Coastal Processes

Studies related to processes involved in coastal erosion and littoral sediment transport.

Within each of these broad categories were a variety of topics of investigation that were site specific or focused on a specific aspect of one of the three categories.

ROLE OF THE ILLINOIS STATE GEOLOGICAL SURVEY

Investigators from the ISGS were involved in all three of the project categories. The ISGS Principal Investigator (P.I.) from January 1988 through March 1991 was Charles W. Collinson. From April 1991 through the completion of the ISGS work on the project in March 1993, the P.I. was Michael J. Chrzastowski. During the five years of the co-op study, the following ISGS personnel received some degree of funding support for participation or assistance in the study:

Terrie Adams
Christine E. Bough
Michael J. Chrzastowski
Charles W. Collinson
Joel M. Dexter
Anne L. Erdmann
Leon R. Follmer
Christine S. Fucciolo
James W. Geiger
Ardith K. Hansel
Nancy P. Holm
Sharon L. Horstman
Holly D. Hunter

James R. Jennings
Joseph T. Kelleher III
Gregory J. McGovern
Allison M. Meanor
Michael V. Miller
James J. Miner
Beth M. Morgan
Matthew H. Riggs
Christopher L. Rompot
Thomas H. Shaw
Paul D. Terpstra
C. Brian Trask
Dan J. VanRoosendahl

BIBLIOGRAPHY CONTENT AND FORMAT

This bibliography is a compilation of publications for the Southern Lake Michigan Coastal Erosion Study that were authored and co-authored by ISGS members. This is not a complete bibliography of all publications resulting from the study; it is limited to contributions having ISGS authorship. Additional publications not listed here resulted from work by project members of the USGS, Indiana Geological Survey, and researchers from the participating universities.

This bibliography is divided into two parts. PART I is a listing of publications by author grouped according to publication year. PART II is a listing of publications by author grouped according to major topics of investigation. Preceding the bibliographic listing in PART II are brief overviews of each of the topics of investigation.

PART I

PUBLICATIONS LISTED BY PUBLICATION YEAR

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Status of Publications as of March 31, 1993

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- Chrzastowski, M. J., Thompson, T. A., and Trask, C. B., 1993, Coastal geomorphology and littoral cell divisions along the Illinois-Indiana coast of Lake Michigan: Journal of Great Lakes Research, Symposium Volume for the USGS/ISGS/IGS Southern Lake Michigan Coastal Erosion Study, 34 ms p., 8 figs., 1 table (in review).
- Terpstra, P. D., and Chrzastowski, M. J., 1993, 1987 to 1992 beach and nearshore changes in the vicinity of North Point Marina on the Illinois coast of Lake Michigan: U.S. Geological Survey, CD-ROM product; text, ARC/INFO maps and ARC/INFO profiles (in review).

PART II

PUBLICATIONS LISTED BY TOPICS OF INVESTIGATION

Within the overall project design of studies related to geologic framework, lake-level history, and coastal processes, ISGS participants in the Southern Lake Michigan Control Erosion Study contributed publications that related to nine different major topics of investigation plus two field trip guidebooks. The following is a listing of these topics of investigation and a brief description of the purpose and/or focus of study. The topics are listed in alphabetical order.

I Bibliographic Compilations

At the inception of the Southern Lake Michigan Coastal Erosion Study, the ISGS was involved in the compilation of a bibliographic record of Lake Michigan research. This work began under a contract from the Joyce Foundation and Illinois Department of Energy and Natural Resources, and was then expanded and completed through funding obtained in the USGS-sponsored Southern Lake Michigan Study.

II Chicago Lakefront Studies

The record high lake levels in 1986 and the high-wave events occurring during the high lake levels resulted in heightened public and government-agency concern for the advanced stage of deterioration along the Chicago lakefront. One concern was identifying the causes of failure along the city's timber and stepped-stone revetments. The Southern Lake Michigan Study used sidescan sonar to examine the underwater condition of the shore structures. In addition, bathymetric studies were completed along selected nearshore reaches. A report published by the ISGS (Chrzastowski and Schlee, 1988) presented the first definitive model of the coastal processes leading to revetment failure. A paper published in *Shore and Beach* (Chrzastowski, 1991) summarizes the problems of structural deterioration and erosion along the Chicago lakefront, and the proposed designs for rebuilding the lakefront.

III Coastal Evolution

As part of the project division focused on geologic framework, the evolution of the southern shore of Lake Michigan was examined for the past 14,000 years since glacial ice first receded from the end moraines that border the southern lake margin. The paleogeographic reconstructions resulting from this work revised some of the previous reconstructions done in the late 1800s and

early to middle 1900s. Issues addressed and resolved were the limits of the littoral drift convergence along the southern lakeshore, when this convergence first developed, and the role of coastal processes in the evolution of the drainage patterns for the Little Calumet, Grand Calumet, and Chicago Rivers. Additionally it was recognized that over the past 2,000 years or so, two areas of substantial coastal erosion in southern Lake Michigan have been the shore along the central Chicago lakefront and the shore in the vicinity of the Illinois-Indiana state line. Of the several abstract and short papers resulting from this work, the most complete summary is a paper included in SEPM Special Publication No. 48 (Chrzastowski and Thompson, 1992).

IV Coastal Management Issues

A short paper and two abstracts resulted from participation in a workshop and two scientific meetings at which ISGS gave talks addressing how coastal management relates to coastal geology and coastal processes. The workshop was held in 1987 at the University of Michigan and was sponsored by the Michigan Sea Grant College Program. This workshop addressed research needs for coastal erosion throughout the entire Great Lakes system. Talks given at scientific meetings were the 1988 North-Central Section meeting of the Geological Society of America, and the 1989 annual meeting of the Illinois State Academy of Sciences.

V Illinois Beach State Park Stratigraphy and Sedimentology

The Southern Lake Michigan Coastal Erosion Study addressed the issue of lake-level history over the past 5,500 years in order to determine if lake levels in the recent geologic past exceeded the extreme levels that have occurred during historical time. Along the Illinois shore, studies were conducted along the beach-ridge plain located south of the Wisconsin-Illinois state line. Along three coast-perpendicular transects, vibracores were collected and examined to determine elevation of plunge-point deposits that record elevation of lake level at the time of ridge formation. Inter-ridge basal peats were radiocarbon dated to provide minimum dates for the ridge formation and associated lake level. The studies at Illinois Beach State Park did not result in definitive information regarding lake level history, but new and more detailed information was gained concerning age control for beach ridge formation and the evolution of this coastal landform.

VI Indiana Shoals Sedimentology and Geomorphology

An initial concern of this study was to examine potential offshore sand reservoirs that could be used as borrow sites for replenishing and building beaches, particularly along the Chicago lakefront. The Indiana Shoals is a broad, bathymetric high that straddles the Illinois-Indiana state line. The shoals had been used as a borrow site for sand and gravel during construction of lakefill along the Chicago lakefront in the early 20th century. The shoals were examined to determine if this area could again be a sand reservoir and borrow site. Sidescan sonar, bathymetric mapping, and bottom samples were collected to characterize the shoal area. The primary publication resulting from this work will be published by the USGS.

VII Littoral Transport Processes

The coastal processes component of this study examined various processes causing coastal erosion and the effects of coastal erosion. Investigation topics included the role of ice in the transport of sediment from the coast, erosion across the glacial-till lake bottom, changes to the littoral transport patterns caused by the construction of littoral transport barriers, and historical changes to shorelines and beach morphology. A short paper addressing the natural-state littoral transport rate along the Chicago lakefront (Chrzastowski, 1990) provides a reference as to the degree that urban development has altered littoral transport along the Chicago lakefront, and an estimate of the volume of sediment that has not been supplied to the Indiana coast because of the Chicago lakefront development. A paper published through the Illinois-Indiana Sea Grant College Program (Shabica *et al.*, 1991) documents the degree of historical depletion of sand thickness along selected beach and nearshore profile lines of the northern Illinois coast.

VIII North Point Marina Coastal Monitoring

In 1987 the State of Illinois began construction on North Point Marina located adjacent to the Wisconsin-Illinois state line. This 1500-slip marina, largest in the Great Lakes, straddles the preconstruction shoreline and was constructed by a combination of excavating a marina basin into the beach and backshore and constructing shore-attached, rubble-mound breakwaters that extended into the nearshore zone. Approximately 1.2 million cubic meters of sand and gravelly sand were excavated and placed on the marina's south (downdrift) shore as a feeder beach to provide downdrift nourishment. The project provided an unprecedented opportunity to monitor beach and nearshore changes along this reach of the Illinois coast resulting from the marina

construction. Annual beach and nearshore bathymetric profiling was conducted from 1988 through 1992. Annual bathymetric maps and annual lake-bottom change maps were prepared. This monitoring assisted the Illinois Department of Conservation in the sand management and coastal erosion mitigation near the marina. All digital map data from the monitoring program are compiled in a CD-ROM product published by the USGS (Terpstra and Chrzastowski, 1993, in review). A paper published in *Journal of Coastal Research* (Terpstra and Chrzastowski, 1992) summarizes the erosional development of a logarithmic-spiral embayment downdrift from the marina.

IX Olson Site Investigations

During the summer of 1989, salvage operators discovered a site of rooted tree stumps on the floor of southern Lake Michigan approximately 25 km east-southeast of the Chicago Harbor Lighthouse. Radiocarbon dating of three samples from three different stumps determined a median age of about 8,300 years B.P. (Pranschke *et al.*, 1990). The location is now known as the Olson site, named after the lead salvage operator (A. Olson) responsible for the discovery. Sidescan-sonar and seismic-reflection surveys were conducted across the area in 1990 in order to provide additional information on the geological setting (Chrzastowski, *et al.*, 1990). A paper published in *Journal of Great Lakes Research* (Chrzastowski, *et al.*, 1991) summarizes results of the preliminary site investigations. The Olson site provides unprecedented data on lake-level history during the Chippewa low phase of ancestral Lake Michigan (approx. 10,000 - 5,500 years B.P.) and thus provided a means to expand the time frame for reconstructing lake-level history.

X Field Trip Guidebooks

Several field trips were held along the Illinois and Indiana coast during the tenure of the Southern Lake Michigan Coastal Erosion Study. These trips highlighted findings of the study and the variety of erosion and coastal management issues along this coast. Two field trips for scientific meetings resulted in published guidebooks. A guidebook was prepared for a pre-meeting fieldtrip associated with the 24th Annual Meeting of the North-Central Section of the Geological Society of America held in Macomb, Illinois in April 1990 (Collinson, *et al.*, 1990). A guidebook was prepared for a post-meeting fieldtrip associated with the 34th Annual Meeting of the Association of Engineering Geologists held in St. Charles, Illinois in October 1991 (Chrzastowski, 1991).

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